[0636] In the AMR device, the hard bias layer **356** is magnetized in the X direction as shown, and the magnetoresistive layer **354** is supplied with the bias magnetic field in the X direction by the hard bias layer **356**. Furthermore, the magnetoresistive layer **354** is supplied with the bias field in the Y direction by the soft magnetic layer **352**. With the magnetoresistive layer **354** supplied with the bias magnetic fields in the X direction and Y direction, a variation in magnetization thereof in response to a variation in the magnetic field becomes linear. The direction of the advance of the recording medium is aligned with the Z direction. When a leakage magnetic field from the recording medium in the Y direction is applied, the magnetization direction of the magnetoresistive layer **354** varies, causing a variation in the resistance. The resistance variation is then detected as a voltage variation.

[0637] In the twenty-fourth embodiment of the present invention, the intermediate layers **357** and **357**, made of the high-resistivity material or the insulating material, formed between the hard bias layers **356** and **356** and the electrode layers **358** and **358**, control the sense current shunting into the hard bias layer **356**. With the electrode layers **358** and **358** extending over the top surface of the multilayer film **361**, the sense current directly flows from the electrode layer **358** to the multilayer film **361**.

[0638] Since the sense current flows to the multilayer film **361** from the electrode layer **358** formed on and in contact with the multilayer film **361**, the percentage of the sense current flowing into the magnetoresistive layer **354** formed as the top layer of the multilayer film **361** is increased. The shunting of the sense current to the soft magnetic layer **352**, which is a typical problem in the conventional art, is thus controlled. Compared with the conventional art, this invention thus achieves a high reproduction gain and a high reproduction output.

[0639] Even if the thickness h**4** of the electrode layer **358** is made thin relative to that of the multilayer film **361**, the use of the intermediate layer **357** permits the sense current to effectively flow from the electrode layer **358** to the multilayer film **361** without passing through the hard bias layer **356**. This arrangement reduces the size of a step between the top surface of the electrode layer **358** and the top surface of the multilayer film **361**, and forms an upper gap layer **379** over the border area between the electrode layer **358** and the multilayer film **361**, with an improved step coverage and with no film discontinuity involved, and provides sufficient insulation.

[0640] In the twenty-fourth embodiment, the sensitive region E and insensitive regions D and D of the multilayer film **361** are measured using the micro track profile. The portion having a width dimension T19 centrally positioned in the multilayer film **361** is the sensitive region E, while the portions, each having a width dimension T20, are the insensitive regions D and D.

[0641] Referring to **FIG. 39**, in this invention, the electrode layer **358** deposited on the multilayer film **361** extends over the insensitive region D by a width dimension T21.

[0642] The width dimension of the top surface of the multilayer film **361** not covered with the electrode layers **358** and **358** is defined as the optical read track width O-Tw. The width dimension T19 of the sensitive region E not covered with the electrode layers **358** and **358** is defined as the magnetic read track width M-Tw. In this embodiment, the electrode layers **358** and **358** extending over the multilayer film **361** fully cover the insensitive regions D and D. The optical read track width O-Tw and the width dimension T19 of the sensitive region E (the magnetic read track width M-Tw) are approximately equal to each other.

[0643] It is not a requirement that the electrode layers **358** and **358** fully cover the insensitive regions D and D. The width dimension T21 of the electrode layer **358** extending over the multilayer film **361** may be smaller than the insensitive region D. In this case, the optical read track width O-Tw becomes larger than the magnetic read track width M-Tw.

[0644] With the electrode layers **358** and **358** extending over the insensitive regions D and D of the multilayer film **361**, the sense current predominantly flows into the sensitive region E of the magnetoresistive layer **354**, thereby increasing the reproduction output.

[0645] The method of manufacturing the magnetoresistive-effect device of the present invention is now discussed referring to drawings.

[0646] Referring to **FIG. 40, a** multilayer film **371** of the magnetoresistive-effect device is formed on a substrate **370**. The multilayer film **371** can be any of the multilayer films of the single spin-valve type thin-film devices shown in **FIGS. 35 and 36**, and the multilayer film of the dual spin-valve type thin-film devices shown in **FIG. 38**, and the multilayer film of the AMR devices shown in **FIG. 39**. To form the antiferromagnetic layer **330** in its extended form in the X direction as shown in **FIG. 37**, an etch rate and etch time are controlled to leave the side portions of the antiferromagnetic layer **330**, when the sides of the multilayer film **371**, shown in **FIG. 40**, are etched away. When the multilayer film **371** is a multilayer film for a single spin-valve type thin-film device or a dual spin-valve type thin-film device, the antiferromagnetic layer **330** in the multilayer film **371** is preferably made of a PtMn alloy, or may be made of an X—Mn alloy where X is a material selected from the group consisting of Pd, Ir, Rh, Ru, and alloys thereof, or a Pt—Mn—X' alloy where X' is a material selected from the group consisting of Pd, Ir, Rh, Ru, Au, Ag, and alloys thereof. When the antiferromagnetic layer is made of one of the above-cited materials, the antiferromagnetic layer needs to be subjected to a heat treatment to generate an exchange coupling magnetic field in the interface with the pinned magnetic layer.

[0647] **FIG. 33** shows a conventional magnetoresistive-effect device having its hard bias layers and electrode layers on only both sides of the multilayer film. The width dimension A of the top surface of the multilayer film of the conventional magnetoresistive-effect device is measured using the optical microscope as shown in **FIG. 31**. The magnetoresistive-effect device is then scanned across a micro track having a signal recorded thereon, on a recording medium in the direction of the track width, and a reproduction output is detected. A top width dimension of B giving an output equal to or greater than 50% of a maximum reproduction output is defined as the sensitive region E and a top width dimension of C giving an output smaller than 50% of the maximum reproduction output is defined as the insensitive region D.